

New Patent Claims

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1. A method for installation of an elongate process unit (4) on the seabed, in
5 which said process unit (4) has a first process unit end (4a) and a second process unit end
(4b),

characterized in that said method comprises the following steps:

- a) preparing and moving said process unit (4) to a position in which it is ready for
being launched from a vessel (24) and lowered through the sea with its
10 longitudinal axis in a generally vertical orientation;
- b) launching said process unit (4) from said vessel (24);
- c) lowering said process unit (4) through the sea surface, the splash zone and
further down to a deployment site at the seabed;
- d) after said process unit lowering step c), entering said first process unit end (4a)
15 into a receptor device (1) for said first process unit end (4a), so as to temporarily
form a lower end of said first process unit end (4a), the receptor device (1) being
located on the seabed or on a module foundation (12) for said process unit (4) at
the seabed;
- e) completing said process unit entry in said receptor device (1) and retaining said
20 first process unit end (4a) in place in said receptor device (1); and
- f) lowering said second process unit end (4b) so as to bring the process unit (4) as a
whole from the generally vertical orientation to a generally horizontal orientation
on the seabed or on said module foundation (12) for said process unit (4), said
first process unit end (4a) remaining supported by said receptor device (1), so as
25 to form a fulcrum for said first process unit end (4a), thus facilitating lowering of
said second process unit end (4b), and
- g) deploying said process unit (4) at the deployment site.

2. Method according to claim 1,

30 characterized in that said process unit entry step d) further comprises the step of:

- guiding said process unit (4) to said receptor device (1) before entering said first
process unit end (4a) of said process unit into said receptor device (1).

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3. Method according to the preceding claims,
characterized in that said preparation and moving step a) and said launching step b)
further include the following steps:

- moving and guiding said process unit (4) towards the stern end of said vessel
(24), said first process unit end (4a) facing said stern end of said vessel (24);
- launching said first process unit end (4a) over a stern roller (29) located at said
stern end of said vessel (24).

4. Method according to claim 3,

characterized in that said process unit moving and guiding step is accomplished by
conveying said process unit (4) to said stern end of said vessel (24) by means of a vessel crane
or vessel winch (31), preferably having a heave compensator (37), the vessel crane or vessel
winch (31) controlling a vessel wire system (36) which is attached to said process unit (4), so
as to safely retain and guide said process unit (4).

5. Method according to any of the preceding claims,

characterized in that a receptor device (1) is arranged on said vessel, and that said
preparation and moving step a) and said launching step b) further include the following steps:

- entering said first process unit end into said receptor device (1) for said first
process unit end (4a) so that said first process unit end (4a) engages said
receptor device (1), so as to temporarily form a lower end of said first process
unit end (4a);

completing said process unit entry in said receptor device (1) and retaining said
first process unit end (4a) in place in said receptor device (1), so as to form a
fulcrum for said first process unit end (4a);

- lifting said second process unit end (4a) while said first process unit end (4a)
remains supported by said receptor device (1), thus facilitating lifting of said
second process unit end (4b) so as to bring the longitudinal axis of said process
unit (4) to a generally vertical orientation;

moving said process unit (4) in said generally vertical orientation to a position in
which it is ready to be launched into the sea; and

- launching said process unit (4) with its longitudinal axis in a generally vertical
orientation into the sea.

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6. Method according to any of the preceding claims, characterized in that said preparing and moving step a) further comprises the step of:
- transferring said process unit (4) from a transport frame (13) to a vessel deck (14) on said vessel (24).

7. Method according to any of the preceding claims, characterized in that a framework (34) including one or more process unit mating pins (6) is attached to said first process unit end (4a) of said process unit (4), so that said process unit entry step d) further includes the following step:

guiding said first process unit end (4a) into engagement with said receptor device (1) by means of said one or more process unit mating pins (6) being brought into engagement with said receptor device (1).

8. Method according to any of the preceding claims,

characterized in that said process unit (4) includes at least two launch beams (5) for facilitating generally horizontal movement of said process unit (4) and for providing support for said process unit (4) on the seabed, on said module foundation (12), on a process subsea skid (23), said vessel deck (14), or on said transport frame (13) on said vessel deck (14).

9. Method according to any of the preceding claims,

characterized in that said completing and retaining step e) further includes the following step:

locking and retaining said first process unit end (4a) of said process unit (4) in place in said receptor device (1) by means of a lock pin (11), so as to retain said one or more process unit mating pins (6) included in said framework (34) attached said first process unit end (4a) of said process unit (4) in said receptor device; said lock pin (11) preferably being spring loaded and ROV releasable.

10. Method according to the preceding claims,

characterized in that

said method further comprises the step of:

keeping control of said second process unit end (4b) of said process unit (4) by means of said vessel wire system (36) including a lowering wire (19) from said vessel crane or vessel winch (31) on said vessel (24);

said process unit lowering step c) further includes the step of positioning said vessel (24) generally above said receptor device (1) in the sea and lowering said process unit (4) in the sea with its longitudinal axis in a generally vertical orientation down to said receptor device (1);

said process unit end lowering step f) further includes the step of positioning said vessel (24) so that the weight of said process unit (4) is gradually transferred to said lowering wire (19), so as to start lowering of said second process unit end (4b) towards the seabed or said module foundation (12) about said fulcrum formed by said first process unit end (4a) engaging said receptor device (1),

moving said vessel to a position so that an axial force component of the tension generated by said process unit (4) in said lowering wire (19) is directed towards said receptor device; so that said axial force component is generally parallel with the longitudinal, central axis of said process unit (4); and so that transversal force components of said force in said lowering wire (19) from said second process unit end (4b) of said process unit (4) to said vessel (24) are reduced or minimized;

thus retaining said first process unit end (4a) in engagement with said receptor device, and reducing or minimizing the risk of disengagement of said first process unit end from said receptor device (1).

11. Method according to any of the preceding claims,

characterized in that

- said process subsea skid (23), or said transport frame (13) or similar, includes
 - a guide and cradle (15) arranged for supporting the load of said process unit (4) to said module foundation (12) or said transport frame (13);
 - one or more, preferably two pairs of wedges (26) being adjustable in order to align said process unit (4) on said process subsea skid (23) or said transport frame (13), so as to bring the longitudinal axis of said process unit (4) to the generally same level as said receptor device (1) engaging said first process unit end (4a) of said process unit (4), thus relieving the load of said process unit (4) from said receptor device (1) to the module foundation (12); and that
- said process unit 4 includes a process unit saddle (16) arranged for transferring the load of said process unit (4) to said guide and cradle (15).

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12. Method according to any of the preceding claims,

characterized in that said wire system 36 on said vessel (24) includes

- one or more launch wires (22), extending from said vessel winch (31) or a
5 separate winch via a snatch block (25) for each launch wire (22) to an attachment
location on said vessel; said snatch block (25) being located at the stern end of
said vessel (24);

- a launch control-wire with bridle (20) connected to a separate winch;

- a lowering wire (19) connected to a separate winch (31) and to said second
10 process unit end (4b) of said process unit (4).

13. Method according to any of the preceding claims,

characterized in that after the deployment step g), it further comprises the step of:

h) loosening or removing said receptor device (1) from said first process unit end
15 (4a).

14. Method according to any of the preceding claims,

characterized in that said elongate process unit (4) is a horizontal gravitational
separator.

15. Method according to any of the preceding claims 5 - 14,

characterized in before said preparation and moving step a) and said launching step
b):

- placing a receptor device (1), including a transport frame (13), with the process
25 unit (4) in engagement with said receptor device (1) on the flatbed of a lorry,

truck, railway carriage or other wheel carriage,

- transporting said receptor device (1) with said process unit (4) to said vessel
(24), and

- lifting said receptor device (1) with said process unit (4) onto said vessel (24).

16. A method of retrieving an elongate process unit (4) from the seabed, in which
said process unit (4) has a first process unit end (4a) and a second process unit end (4b),

characterized in that said method comprises the following steps:

a) preparing said process unit (4) for removal from a deployment site;

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- b) lifting said second process unit end (4b) from the seabed or from a module foundation (12) for said process unit (4), said first process unit end (4a) being retained in a receptor device (1), thus temporarily forming a lower end of said first process unit end (4a), and so as to bring the longitudinal axis of said process unit (4) as a whole from the generally horizontal orientation to a generally vertical orientation; said first process unit end (4a) of said process unit (4) and said receptor device (1) forming a fulcrum for said first process unit end (4a), thus facilitating lifting of said second process unit end (4b);
- c) disengaging said first process unit end (4a) from said receptor device (1);
- 10 d) hauling said process unit (4) from said deployment site at the seabed, up through the sea, the splash zone and the sea surface to a vessel (24);
- e) bringing said process unit (4) aboard said vessel (24), and
- g) preparing and moving said process unit (4) to a generally horizontal position onboard said vessel, in which it is sea-fastened and ready for being transported
- 15 on said vessel (24).

17. Receptor apparatus for use in a process unit handling operation, in which the process unit (4) to be handled comprises a first process unit end (4a) and a second process unit end (4b),

20 characterized by the following features:

- a receptor device (1) arranged for receiving and engaging a first process unit end (4a), and further arranged for receiving and supporting the load of said process unit (4), and
- said receptor device (1) being arranged for receiving and engaging said first process unit end (4a), and said receptor device (1) further being arranged for
- 25 retaining said first process unit end (4a) in place in said receptor device (1) and providing a fulcrum for said first process unit end (4a) during handling of said second process unit end (4b) and being adapted to take up a substantial part of the weight of the process unit when the process unit as a whole is transferred
- 30 between a substantially vertical position and a substantially horizontal position.

18. Receptor apparatus for use in a process unit handling operation, in which the process unit (4) to be handled comprises a first process unit end (4a) and a second process unit end (4b),

characterized by the following features:

- a receptor device (1) arranged for receiving and engaging a first process unit end (4a), and further arranged for receiving and supporting the load of said process unit (4),
- 5 - said receptor device (1) being arranged for receiving and engaging said first process unit end (4a), and said receptor device (1) further being arranged for retaining said first process unit end (4a) in place in said receptor device (1) and providing a fulcrum for said first process unit end (4a) during handling of said second process unit end (4b) and being adapted to take up a substantial part of the weight of the process unit when the process unit as a whole is transferred between a substantially vertical position and a substantially horizontal position,
- 10 - said receptor device (1) comprises two or more receptor brackets (27) in a spaced apart arrangement, each receptor bracket (27) having a receptor bracket guide (28); and that
- 15 - said receptor bracket guides (28) included in said receptor brackets (27) are each arranged for receiving a process unit mating pin (6) included in said framework (34) which is attached to said first process unit end (4a), so that said receptor brackets (27) form support bearings (2) for said process unit (4) via said process unit mating pins (6) when engaged with said first process unit end (4a) of said process unit (4); thus forming a fulcrum for said first process unit end (4a) of said process unit (4).
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19. Receptor apparatus for use in a process unit handling operation, in which the process unit (4) to be handled comprises a first process unit end (4a) and a second process unit end (4b),

25 characterized by the following features:

- a receptor device (1) arranged for receiving and engaging a first process unit end (4a), and further arranged for receiving and supporting the load of said process unit (4),
- 30 - said receptor device (1) being arranged for receiving and engaging said first process unit end (4a), and said receptor device (1) further being arranged for retaining said first process unit end (4a) in place in said receptor device (1) and providing a fulcrum for said first process unit end (4a) during handling of said second process unit end (4b) and being adapted to take up a substantial part of

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the weight of the process unit when the process unit as a whole is transferred between a substantially vertical position and a substantially horizontal position, a receptor cylinder (9) in connection with said receptor (1a), said receptor cylinder (9) arranged for receiving and engaging said first process unit end (4b), two or more receptor bearings (2) in a spaced apart arrangement on said module foundation (12); said receptor bearings (2) being arranged for supporting the load of said process unit (4); each receptor-bearing (2) being provided with a receptor rotating pin (3) so as to form a fulcrum for said receptor device (1), said receptor (1) and said receptor cylinder (9) being arranged for receiving a process unit mating pin (6) attached to said first process unit end (4a) of said process unit (4).

20. Receptor apparatus according to claim 17, 18 or 19,

characterized in that said receptor device (1) is arranged on a module foundation (12) arranged for supporting said receptor device (1) and the load from said process unit (4).

21. Receptor apparatus according to claim 17 or 20,

characterized in that said receptor device (1) is arranged for receiving one or more process unit mating pins (6) included in a framework (34) being attached to said first process unit end (4a) of said process unit (4).

22. Receptor apparatus according to claim 21,

characterized in that

said receptor device (1) comprises two or more receptor brackets (27) in a spaced apart arrangement, each receptor bracket (27) having a receptor bracket guide (28); and that

said receptor bracket guides (28) included in said receptor brackets (27) are each arranged for receiving a process unit mating pin (6) included in said framework (34) which is attached to said first process unit end (4a), so that said receptor brackets (27) form support bearings (2) for said process unit (4) via said process unit mating pins (6) when engaged with said first process unit end (4a) of said process unit (4); thus forming a fulcrum for said first process unit end (4a) of said process unit (4).

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23. Receptor apparatus according to any of the claims 17-22,

characterized in that said receptor device (1) comprises

- a receptor (1a) arranged for receiving and engaging a first process unit end (4a) of a process unit (4);
- a receptor cylinder (9) in connection with said receptor (1a), said receptor cylinder (9) arranged for receiving and engaging said first process unit end (4b),
- a receptor dampening or yielding member (8) located in said receptor cylinder (9); said receptor dampening member (8) being arranged for receiving the load of said process unit (4) and for dampening or minimizing the impact of the load of said process unit (4) by said first process unit end (4b) on said receptor device (1),
- two or more receptor bearings (2) in a spaced apart arrangement on said module foundation (12); said receptor bearings (2) being arranged for supporting the load of said process unit (4); each receptor bearing (2) being provided with a receptor rotating pin (3) so as to form a fulcrum for said receptor device (1),
- each receptor bearing (2) optionally being provided with a dampening pad (7), so as to dampen the impact when said receptor device (1) receives and engages the load of said process unit (4) and for assisting said dampening member (8) in said receptor device (1) in receiving and supporting this load.
- said receptor (1) and said receptor cylinder (9) preferably being arranged for receiving a process unit mating pin (6) of a framework (34) attached to said first process unit end (4a) of said process unit (4).

24. Receptor apparatus according to claim 23,

characterized in that said receptor cylinder (9) is provided with a rotational guide (10a) arranged for engaging a corresponding guide formation or shoulder (10b) on said process unit mating pin (6), so as to facilitate rotation of said process unit mating pin (6) in said receptor cylinder (9).

25. Receptor apparatus according to any of the claims 17-24,

characterized in that

- it is located at the seabed, preferably on a module foundation (12) at the seabed, and arranged for facilitating deployment or removal of a process unit (4) on the seabed, or that

- it is located on said vessel (24) and arranged for facilitating launching of said process unit (4) into the sea, for loading onto said vessel (24) and for transport of said process unit (4) on said vessel (24).

- 5 26. Use of a receptor apparatus according to any of the preceding claims for
- handling of said first process unit end (4a) of said process unit (4) so as to
- facilitate preparation aboard a vessel (24) for launch of said process unit (4) into
- the sea, or
- handling of said first process unit end (4a) of said process unit (4) so as to
- 10 facilitate preparation of said process unit (4) aboard a vessel (24) for transport of
- said process unit (4); or
- handling of said first process unit end (4a) of said process unit (4) for
- deployment of said process unit (4) onto said module foundation (12) arranged at
- a deployment site at the seabed, or
- 15 - handling of said first process unit end (4a) of process unit (4) for removal of
- said process unit (4) from said module foundation (12) arranged at a deployment
- site at the seabed.